Loads & Dynamics HWG – Laurence C. Hanson, Chairman 8 September 2001

ARAC L&DHWG Response Regarding the Costs and Benefits of the FAR 25 Harmonization Proposal for Checked Pitching Maneuver Requirement for Transport Airplanes

1. OVERVIEW

The FAA proposes to revise the checked pitching maneuver design load requirement of 14 CFR part 25 for transport category airplanes by incorporating changes developed in cooperation with the Joint Aviation Authorities (JAA) of Europe, Transport Canada and the U.S., European, and Canadian aviation industries through the Aviation Rulemaking Advisory Committee (ARAC). A checked pitching maneuver results when the cockpit pitch control is displaced to cause the airplane to pitch, but then the control is displaced in the opposite direction to arrest (check) the pitching motion. This rulemaking action concerns the design loads associated with the checked pitching maneuver and is necessary because differences between the current U.S. and European requirements impose unnecessary costs on airplane manufacturers. These proposals are intended to benefit the public interest by standardizing certain requirements, concepts, and procedures contained in the airworthiness standards without reducing, but potentially enhancing, the current level of safety.

- **Why are New Standards Needed?**

Section 25.331(c)(2) of part 25 prescribes a checked pitching maneuver in which the cockpit pitch control is first displaced in a nose up direction, then the control is displaced in the opposite direction sufficient to "check" the pitching motion. The control displacements must develop specified nose up and nose down pitching accelerations. The magnitude of these control inputs must be such that the positive limit maneuvering load factor prescribed in § 25.337 is achieved on the airplane, but not exceeded.

The corresponding requirement in JAR-25 is similar, however, there are no specific minimum pitching accelerations that must be achieved. Rather, JAR paragraph 25.331(c)(2) requires a rational motion. This rational motion is not defined in the rule but the associated advisory material, Advisory Circular Joint (ACJ) 25.331(c)(2), prescribes a control motion in the form of a sine wave. This control motion is applied with the initial movement in the nose-up direction so that the maximum positive limit maneuvering load factor is achieved. As a separate condition, the control motion is applied with the initial movement in the nose-down direction, so that a maneuvering load factor of 0g is reached. In both cases, the control motion is applied at a frequency related to the short-period rigid body mode of the airplane. The short-period rigid body mode is one of the two longitudinal stability modes that are inherent in every airplane and identified during the design phase.

(Handout 9)

The main criticism of the current FAR requirement is that the pitching accelerations are prescribed without any accounting for the size, configuration or characteristics of the airplane. In fact, the same pitching accelerations are applied to the smallest personal airplanes as to the largest jet transports. The JAR requirement, on the other hand, relates the frequency of the control motion to the frequency of the short-period rigid body mode of the airplane, thereby accounting for the characteristics of the particular airplane. Neither the FAR nor the JAR provide adequate criteria to fully account for the characteristics of advanced electronic flight control systems in which the achievable maneuvering load factors are governed by special computer control laws.

- **What are the Proposed Standards?**

The proposed standards are provided in the attached NPRM titled "Checked Pitching Maneuver Requirement for Transport Airplanes." The NPRM proposes to revise paragraph 25.333(c)(2).

2. Cost Discussion

The proposed harmonization standard will not impose additional significant cost on U.S. manufacturers of part 25 airplanes because:

1. There is no significant cost burden due to the changes to analysis requirements as the NPRM harmonizes both the FAA and JAA requirements. The NPRM is based upon the JAA requirements that most manufacturers have chosen to previously comply with.

2. Any changes to the loads requirements that result from this NRPM will not result in significant costs for certification or manufacturing. In addition there will be no significant increases in weight.

3. Benefits Discussion

A common set of standards will benefit the aviation industry economically due to meeting just one certification requirement rather than different standards for the United States and Europe. Airplane manufacturers already meet or expect to meet this standard as well as the existing Part 25 requirement.

The proposed standards will maintain the existing level of safety.

4. L&D HWG Recommendation

Six U.S. Part 25 airframe manufacturers having members on the L&D HWG were asked to respond to the Costs and Benefits sections of this economic evaluation which reflects the cost/benefits determination of the FAA Regulatory Evaluation Summary as contained in the proposed NPRM. The response letters received from the six manufacturers are attached.

All six of the companies accepted the cost/benefits. One company commented that:

"It should be noted that the economic assessment does not take into account the impacts this later certification requirement may have on aircraft certification programs subject to the new FAR 21.101 changed products rule requirement. The level of economic impact and impracticality of applying this rule to existing programs would have to be performed under the criteria defined by FAR 21.101 and AC 21.101-1."

The L&DHWG requests that in the next to the last paragraph of the Regulatory Evaluation Summary that the sentence:

"There was consensus within the ARAC members, comprised of representatives of the affected industry, that the requirements of the proposed rule will not impose additional costs on U.S. manufacturers of part 25 airplanes"

be changed to:

"There was consensus within the *U.S. members of the ARAC L&DHWG*, comprised of representatives of the affected industry, that the requirements of the proposed rule will not impose additional costs on U.S. manufacturers of part 25 airplanes"

The above change clarifies the fact that the U.S. members of the ARAC L&DHWG are the ones that have participated in the economic evaluation as opposed to all ARAC members.

In addition, it is requested that the previously discussed comment made by one company be discussed in the NPRM.

The U.S. members of the ARAC L&DHWG therefore recommend that the FAA proceed with this rulemaking with the changes as discussed above.

Loads and Dynamics Harmonisation Working Group Work Plan

Flight Loads Survey Task

6 September 2001

The L&D HWG (Incorrectly stated as GSHWG) was tasked via FR Doc. 01-14659 as published 11 June 2001 to perform the following:

Specific Task

- Review 14 CFR Part 25, § 25.301 and JAR 25.301 for adequacy in addressing the issue of validation of flight load intensities and distribution. This review should include the consideration of:

1. FAA advisory circular (AC) 25-14, High Lift and Drag Devices;"
2. Relevant FAA issue papers and their implementation
3. JAA Certification Review Items

- Develop a report recommending the any revisions to the rules (including cost estimates) and any advisory materials needed to address the above issues.

Schedule: This task is to be completed no later than June 28, 2002 is.

Work Methods

The Loads and Dynamics Harmonization Working Group will comply with the procedures adopted by ARAC. As a part of the procedures, the Loads and Dynamics Harmonization Working Group is submitting to the TAEIG this work plan for completion of the tasks, including the rationale for the plan.

A status report on the tasks will be provided at each meeting of ARAC held to consider Transport Airplane and Engine Issues.

Detailed Work Plan

The chairman of the HWG has appointed a task group, with a chairman and co-chairman, to handle the tasks with the intent of expediting the completion of the assigned task. The membership of the task group is provided via Attachment 1. The membership of the group consists of selected members from the HWG.

Attachment 8

The charter of the task group is to review and analyse the appropriate materials and data and to development the draft reports, advisory material, or any other collateral documents that are found to be appropriate. The draft report is to include an economic evaluation. The work of this task group is to be accomplished between the HWG meetings and brought forward at each L&D HWG meeting for review and comment. Most of the work will be accomplished by teleconference and email. However the chairman of the task group may call task group meetings if required.

1. Review

- 14 CFR Part 25, § 25.301 and JAR 25.301 for adequacy in addressing the issue of validation of flight load intensities and distribution. This review should include the consideration of:

  FAA advisory circular (AC) 25-14, High Lift and Drag Devices;"
  Relevant FAA issue papers and their implementation
  JAA Certification Review Items

- Existing airframe manufacturers practices and criteria for measuring flight loads magnitudes and distributions.

2. Identify issues

- What loads should be measured and how should they be measured
- How are measured flight loads currently used in the validation process
- How should they be used in the validation process
- When do differences in measured flight loads relative to certification design loads require evaluation require additional structural substantiation
- What is an appropriate error band for measured loads
- Under what circumstances can measured flight loads be used to show additional capability for increased maximum gross weights or design speed-altitude schedules

These are just some of the issues to be addressed.

3. Discuss and develop necessary rule changes / advisory material

Develop a Fast Track report that would provide the information for:

a) An NPRM
b) An AC
c) Cost Analysis

4. Schedule

a) Technical agreement 22 February 2002
b) Deliverables submitted to TAEIG by early March 2002 (TOR date due to FAA is 28 June 2002)

Identification of Affected Parties

The likely parties to be affected by the harmonization activity are the airframe manufacturers and the JAR Structures Study Group.

Expertise Required

The Group has determined that we have the needed expertise to proceed with the tasks.

Submitted to TAEIG by:

Larry Hanson
Chairman of L&D HWG

Attachment 1

Flight Loads Survey Task Group

Name	Organization
Wim Doeland (Chairman)	RLD
Jack Grabowski	Transport Canada
Hank Offerman	FAA Transport Directorate
Tony Linsdell (Co-chairman)	Bombardier - Canadair
Gennaro Squeglia	Aerospatiale Matra-Airbus
Mark Ray	Gulfstream Aerospace
Mike Green	Boeing